Correlations of Physical Fitness Factors, Antioxidant Enzymes, Lipid Peroxidation, Lipid Profiles, Lactate Levels and Cardiovascular Variables in an Exercising Group and Controls

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Jae-Ho Yu, PT, MS; Suk-Min Lee, PT, PhD[1]

Department of Physical Therapy, Graduate school of Sahmyook University; [1]Department of Physical Therapy, Sahmyook University

Purpose: This study was designed to investigate correlations between physical fitness, antioxidant enzymes (SOD, CAT, GPX), lipid peroxidation levels (MDA), lipid profiles, lactate levels and cardiovascular variables in an exercising group and a control group.

Methods: Twelve healthy young males (Exercise group: 6, Controls: 6). All subjects took physical fitness tests and blood samples were collected while subjects were resting.

Results: In the exercise group, there were several significant correlations: between back strength and SOD enzyme levels (r=0.82, p=0.04), back strength and MDA (r=0.94, p=0.00), agility and GPX (r=0.81, p=0.04), and balance and GPX (r=0.81, p=0.04). In the control group, there were significant correlations between: dominant grip strength and MDA (r=-0.84, p=0.03), and agility and GPX (r= -0.82, p=0.04). In the exercise group, there were no significant correlations between physical fitness factors, TC, TG, HDL-C and lactate levels. In the control group, there were significant correlations between: back strength and TG (r=0.88, p=0.01), and agility and HDL-C (r= -0.84, p=0.03). In the exercise group, there were significant correlations between: non-dominant grip strength and SBP (r=0.94, p=0.00), dominant grip strength and SBP (r=0.85, p=0.03), and power and SBP (r=0.82, p=0.04). In controls, there were significant correlations between: dominant grip strength and DBP (r=-0.85, p=0.03), muscular endurance and ST level (r=-0.93, p=0.00), and muscular endurance and HR (r=-0.88, p=0.01).

Conclusion: That cardiovascular patients and controls who participated in regular exercise maintained their antioxidant capacity suggests that long-term physical activity can counteract the negative dysfunction that characterizes sedentary lifestyle, probably by maintaining plasma antioxidant defenses and thereby preventing oxidative stress.

Keywords: SOD, CAT, GPX, Lactic acid, Short-term exercise

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Corresponding author: Suk-Min Lee, leesm@syu.ac.kr

I. Introduction

With the development in industry, civilization and information, new type diseases had being appeared.[1] Exercise has excellent effect in prevention of variable diseases[2] and for this reason there are high efforts for finding effects of therapeutic exercise not only traditional portion like intension of strength, flexibility and balance but also another mechanism in physical therapy field.[3] Exercise increases the flow of electrons and the use of oxygen through the electron transport system (ETS), also the ETS within the mitochondria, uses most of the oxygen through oxidative phosphorylation to produce energy.[4] But if the electrons of the oxygen could not pair it creates an energetic reaction to absorb electrons from the outside producing free radicals in the process that creates various harmful effects on the inner body.[5] In these free radicals there are superoxide radical anion(O_2-), hydrogen peroxide (H_2O_2), hydroxyl radical (OH-) which are endlessly produced from the unstable reverting process in the body system. But if the concentration of these free radicals exceed the reverting power within the cell the DNA, especially the cell membrane and the DNA may get damaged. The most loss from the DNA damage is the mitochondria genome.[6] This causes the

mitochondria to lose its ability as well as the decrease in oxygen in take and ultimately gives a negative effect on the ability to exercise.[7] On the other hand the damage to protein, nucleic acid and phospholipid by the free radicals produced inside the body are prevented by antioxidant enzymes which are known to contain Superoxide dismutase (SOD), Catalase (CAT), Glutathione peroxidase (GPX).[8] Continuous exercise of the low intensity (VO2max<50%) protects the cells of the body and increases the time to adapt to consumption,[9] such effects of exercise are linked to the increase of vitality of antioxidant enzymes.[10] But extreme exercise has been found to increase the level of free radicals while on the other hand the vitality of antioxidant enzymes has found to be inadequate as well as lowering the function of immunocyte sensitive to virus and bacteria exposing the body to pathogenic bacteria also lowering the functions of immunocyte resistant to cancer cells giving negative effects to maintaining health.[11,12] Physical factors needed to preform an exercise can be classified muscular strength, muscular endurance, reflex, agility, balance. The rate of contribution of each factors differ according to the category of the exercise.[13] Though existing researches deducts the correlation between the intensity of the aerobic exercise and antioxidant enzymes becoming an important element in combating the free radical that induces various diseases including aging,[14] but it is insufficient to be a general ground material for anaerobic exercise, physical factors and cardiovascular variables. There are yet to be materials that elaborately analysis the excretion of antioxidant enzymes according to the category of sports. Therefore this study classify exercise group and controls to 6 Judo athlete those who has high physical fitness by regular exercise and 6 ordinary peoples those who have relatively low physical fitness. After measuring physical fitness, antioxidant enzymes (SOD, CAT, GPX), lipid peroxidation's level (MDA), lipid profile, lactate levels and cardiovascular variables to this target, analysing and comparing between these and identifying the physical factors that increases the vitality rate of antioxidant enzymes and to show the physical therapist which physical factors would affect the healthcare variables.

II. Methods

1. Subjects

This study was conducted at Seoul S hospital, with 12 students from H University. To achieve the goal of this study, which is to see the effects of exercise, 6 judo player that had participated regular exercise three years more (Athletic) and 6 controls (Non-Athletic) with no history of significant illness were chosen as subjects. The physical characteristics are as shown in Table 1.

2. Instruments

Exercised and controls measured grip strength, back strength, muscular endurance, power, agility, flexibility and balance. All subjects had fasted 12 hours before extracting blood for a blood test and they did not eat anything during 8 hours before test. Antioxidant and Lipid peroxidation, lipid compound, concentration of lactic acid, were analysed from the 20 ml of blood extracted. Cardiovascular variables were analysed using the Electrocardiogramme (ECG). Before testing, each subject provided informed consent as required by the investigator and all subjects agreed participation of study.

1) Antioxidant analysis method

(1) SOD analysis method

After extracting 600 μl of whole blood in a herapin treated vacutainer and shaken thoroughly it was centrifuged for 5 minutes at 2,500 g (4℃) to obtain plasma. 400 μl of ice cold extraction reagent was added in to the 250 μl of plasma obtained and Vortex it for 30 seconds to obtain supernatant fluid. And then for 1 minute the extinction rate was measured optical density within 15 seconds at 525 nm.

(2) CAT analysis method

CAT is a method where you start concentration by altering the tone of the chromic material and comparing it with the tone of the standard solution that has been altered in the same method. Afterwards it was cultured under 37℃ for 30 minutes and added

Table 1. Subject characteristics

Group (n)	Age (yr)	Height (cm)	Weight (kg)	Body fat (%)	VO2max (ml/kg/min)
Exercise group (6)	19.83±1.17	169.83±4.58	69.17±3.87	18.56±4.38	59.9±5.57
Controls group (6)	19.83±0.75	174.01±2.28	65.83±4.99	21.84±5.03	48.23±2.97

with 1 ml of titanium sulfate. It was again cultivated for 15 minutes after the mix after which the optical density was measured. Afterwards the extinction rate was measured under 410 nm.

(3) GPX analysis method

500 μl of whole blood was collected in a heparin treated vacutainer and shaken thoroughly. It was then centrifuged for 5 minutes at 2,500 g (4℃) to obtain plasma. 400 μl of Ice cold extraction reagent was added in to the collected plasma and vortexed for 30 seconds to obtain a supernatant fluid. The red blood cell crystal microspherocyte was collected after removing the supernatant fluid after which 6% of metaphospheric acid at 0~4℃ was added in to the microspherocyte and centrifuged at 3000 g (4℃) to obtain red blood cell solvent. Afterwards the extinction rate was measured.

2) Lipid peroxidation (MDA) analysis method

After collecting 20 ml of red blood from the vein after which 3 ml of whole blood, treated with heparin, was centrifuged for 10 minutes at 3000 rpm. The resulting content was added into a tube with plasma to dilute the reagent. It was then heated for 15 minutes in a water bath and centrifuged for 10 minutes at 1000 rpm after cooling. 2 ml of the centrifuged plasma was placed into a curvette and analysed under a Spectrophotometer.

3) Lipid and lactic acid analysis method

After collecting blood from the antebrachial vein the lipid ingredients were analytically quantified through cell disruption method of total Cholesterol (TC), triglyceride (TG), high-density lipoprotein cholesterol (HDL-C). A quantitative analysis of the lactic acid was done by placing collected blood samples in a BM-Lactate analyzer.

4) Cardiovascular variables measurement method

Resting contraction blood pressure, diastolic pressure and heart rate was measured by auto sphygmomanometer. For the resting electrocardiogram by using the 12 electrode system with limb leads and precordial leads, the measurement was taken by electrocardiography through the ECG monitor. Next all of subject was referred for an exercise stress test to evaluate maximal oxygen consumption. Written informed consent was obtained, and maximal ECG treadmill test was performed using the Bruce protocol.

5) Physical fitness measurement method

Physical fitness factor tests are composed referring to Carole et al,[15] Amy and Andrea[16] and the measurement categories and apparatus are as listed on Table 2. The grip strength was measured by using a dynamometer after turning the adjustment lever to adjust the distance to the 2nd joint and gripping on to a measuring device that has been slightly held down from the body. Dominant and non-dominant, both were measured. Measurement range was set at 5.0~100 kg and was carried out using a controlled Potentiometer method. The back strength was measured by standing on the measuring device and pulling with full force while holding on to the handles after adjusting the length. At this point the legs were completely straight so that the subject could not use the leg muscles by bending the legs. The measurement range was set at 20~300 kg and used a controlled Potentiometer method. The muscular endurance was measured after the subject was direct to do sit-ups for 30 seconds. The measurement used a Mirror type photo sensor method. Reflexes were measured by directing the subject to stand on the measuring device and to jump as high as possible. Measurement range was set at 10~190 cm and used a flight duration conversion formular type auto measurement terminal. Agility was measured by moving as quickly as possible back and forth from two yellow lines on either side of the subject. Measuring time was set at 20 seconds and ended at the

Table 2. Physical fitness variables and materials

Testing Equipments	Model (Manufactory)	Year	Measurement
Grip strength tester	SH-9600D, Korea	1997	Grip strength
Back strength tester	SH-9600E, Korea	1997	Back strength
Muscular endurance tester	SH-9600N, Korea	1997	Muscle endurance
Power tester	SH-9600F, Korea	1997	Power
Agility tester	SH-9600J, Korea	1997	Agility
Flexibility tester	SH-9600G, Korea	1997	Flexibility
Balance tester	SH-9600H, Korea	1997	Balance

sound of a buzzer. The test used a mirror type photo sensor method and LED auto lighting line system. Flexibility was measured by directing the subject take off the shoes, and sit down with the back at a 90 degree angle and to stretch both hands towards the feet so that the upper body creates a curve. The range was set at -20～+40 cm. When measuring the balance the subject is directed to take off the shoes and stand on one leg on foot shape of the measuring Instrument with eyes closed while standing on one leg and maintaining the posture. The test time was set for 0～200 seconds and terminated by the sound of the buzzer.

3. Statistical procedure

All data collected through this experiment used the statistics package SPSS/pc+ 12.0. The physical characteristics of each group were analysed through Descriptive Statistics while a Pearson correlation coefficients was done of strength factors (grip, back, muscular endurance, power, agility, flexibility, balance) and super oxide dismutase (SOD, CAT, GPX). Lipid peroxidation (MDA), lipid ingredients (TC, TG, HDL-C), lactic acid, and cardiovascular variables (SBP, DBP, ST-Level, HR). All measurements were shown as average and standard deviation and were verified at significant level $p<0.05$.

III. Results

1. Correlation between physical fitness, antioxidant and MDA

In exercise group, variables that shown significant correlation between physical fitness and antioxidant enzymes, statistically appeared back strength and SOD (r=0.82, p=0.04), agility and GPX (r=0.81, p=0.04), balance and GPX (r=0.81, p=0.04) (Table 3). In controls, variables that shown significant correlation between physical fitness and antioxidant enzymes, statistically appeared agility and GPX (r=-0.82, p=0.04), back strength and MDA (r=0.94, p=0.00), dominant grip strength and MDA (r=-0.84, p=0.03).

2. Correlation between physical fitness, component of lipid and concentration of lactic acid

In exercise group, correlation between physical fitness and TC, TG and HDL, statistically appeared not significant (Table 4). In controls, back correlation between physical fitness and TC, TG and HDL appeared strength and TG (r=0.88, p=0.01), agility and HDL (r=-0.84, p=0.03).

3. Correlation between physical fitness and cardiovascular variables

In exercise group, variables that shown significant correlation between physical fitness and cardiovascular variables, statistically

Table 3. Correlation between physical fitness, antioxidant and MDA

		Exercise group				Controlsgroup			
		SOD	GPX	CAT	MDA	SOD	GPX	CAT	MDA
Non dominant grip strength	r	-0.09	0.43	-0.01	0.15	-0.13	-0.40	-0.47	0.04
	p	0.86	0.38	0.97	0.76	0.80	0.42	0.34	0.93
Dominant grip strength	r	0.02	0.41	0.04	0.29	-0.23	-0.55	0.20	-0.84*
	p	0.95	0.41	0.92	0.56	0.65	0.25	0.70	0.03
Back strength	r	0.82*	0.31	-0.14	0.94**	0.33	-0.03	-0.30	0.23
	p	0.04	0.54	0.78	0.00	0.51	0.95	0.55	0.65
Muscle endurance	r	0.52	0.58	0.09	0.69	-0.33	0.02	0.59	-0.80
	p	0.28	0.21	0.86	0.12	0.52	0.96	0.21	0.05
Power	r	0.33	0.39	-0.60	0.42	0.00	-0.66	-0.24	-0.32
	p	0.51	0.44	0.20	0.40	1.00	0.14	0.64	0.52
Agility	r	0.25	0.81*	-0.31	0.35	0.43	-0.82*	-0.80	0.06
	p	0.62	0.04	0.54	0.49	0.38	0.04	0.05	0.90
Flexibility	r	0.22	-0.40	0.43	0.26	-0.48	0.53	0.32	0.51
	p	0.66	0.42	0.39	0.60	0.32	0.27	0.52	0.29
Balance	r	-0.09	0.81*	0.07	0.08	0.75	0.50	-0.25	0.46
	p	0.86	0.04	0.88	0.87	0.08	0.30	0.63	0.34

SOD: Superoxide dismutase, CAT: Catalase, GPX: Glutathione peroxidase, MDA: Lipid peroxidation's level
*p<0.05, **p<0.01

Table 4. Correlation between physical fitness, component of lipid and concentration of lactic acid

		Exercise group				Controls group			
		TC	TG	HDL	Lactate	TC	TG	HDL	Lactate
Non dominant grip strength	r	-0.12	0.03	0.21	0.15	-0.15	0.53	-0.29	0.46
	p	0.80	0.94	0.68	0.77	0.76	0.27	0.57	0.35
Dominant grip strength	r	-0.30	0.01	0.10	0.14	-0.54	-0.18	-0.10	-0.53
	p	0.55	0.97	0.83	0.79	0.26	0.72	0.83	0.27
Back strength	r	-0.63	0.30	-0.12	0.67	0.78	0.88*	-0.55	0.40
	p	0.17	0.55	0.81	0.14	0.06	0.01	0.25	0.43
Muscle endurance	r	-0.19	0.53	0.17	0.53	-0.05	0.12	0.09	-0.36
	p	0.70	0.28	0.74	0.28	0.92	0.80	0.86	0.48
Power	r	-0.27	-0.00	0.02	0.69	-0.71	-0.45	-0.14	-0.36
	p	0.59	0.99	0.95	0.12	0.11	0.36	0.77	0.47
Agility	r	-0.24	-0.16	-0.53	0.33	0.04	0.52	-0.84*	0.19
	p	0.64	0.75	0.27	0.51	0.93	0.29	0.03	0.71
Flexibility	r	-0.29	0.21	0.14	-0.15	0.64	-0.22	0.63	-0.15
	p	0.57	0.68	0.77	0.77	0.16	0.66	0.17	0.76
Balance	r	0.12	0.08	-0.10	0.06	0.22	0.45	-0.33	0.77
	p	0.81	0.87	0.84	0.90	0.67	0.36	0.51	0.06

TC: Total cholesterol, TG: Triglyceride, HDL: High density lipoprotein cholesterol
*p<0.05

Table 5. Correlation between physical fitness, and cardiovascular variables

		Exercise group				Controls group			
		SBP	DBP	ST level	HR	SBP	DBP	ST level	HR
Non dominant grip strength	r	0.94**	0.05	0.78	0.44	0.76	-0.16	-0.21	-0.30
	p	0.00	0.92	0.06	0.37	0.07	0.76	0.68	0.56
Dominant grip strength	r	0.85*	0.17	0.77	0.41	-0.15	-0.85*	-0.74	-0.38
	p	0.03	0.74	0.07	0.41	0.77	0.03	0.08	0.44
Back strength	r	0.45	0.41	0.24	0.28	0.10	0.08	0.45	-0.10
	p	0.37	0.41	0.63	0.59	0.83	0.87	0.36	0.84
Muscle endurance	r	0.80	0.01	0.64	0.17	-0.35	-0.53	-0.93**	-0.88*
	p	0.05	0.98	0.16	0.74	0.49	0.27	0.00	0.01
Power	r	0.82*	0.34	0.21	0.73	0.10	-0.56	-0.12	0.33
	p	0.04	0.50	0.68	0.09	0.83	0.24	0.82	0.52
Agility	r	0.56	0.47	0.07	0.55	0.42	-0.43	0.52	0.38
	p	0.24	0.33	0.88	0.25	0.40	0.38	0.28	0.45
Flexibility	r	-0.34	-0.06	0.14	-0.42	-0.20	0.70	0.39	0.41
	p	0.50	0.90	0.78	0.40	0.69	0.11	0.43	0.40
Balance	r	0.77	0.00	0.54	0.28	0.10	0.49	0.39	-0.17
	p	0.07	0.98	0.26	0.58	0.83	0.32	0.43	0.74

SBP: Systolic blood pressure, DBP: Diastolic blood pressure, HR: Heart rate
*p<0.05, **p<0.01

appeared non dominant grip strength and SBP (r=0.94, p=0.00), dominant grip strength and SBP (r=0.85, p=0.03), agility and SBP (r=0.82, p=0.04)(Table 5). In controls, variable that shown significant correlation between physical fitness and cardiovascular variables, statistically appeared dominant grip strength and DBP (r=-0.85, p=0.03), muscular endurance and ST level (r=-0.93, p=0.00), muscular endurance and HR (r=-0.88, p=0.01).

IV. Discussion

This study discusses about correlations of the physical fitness, antioxidant enzymes (SOD, CAT, GPX), lipid peroxidation's level (MDA), lipid profile, lactate levels and cardiovascular variables in exercised group who have been to train regularly or controls who have not been to train, as follows.

Antioxidant enzymes are a matter that protects cells from

free radical causing cell damage. It removes toxin from culture fluid that has serum or serum albumin and other high molecule insufficiency. Free radical damages cell membrane to superoxide anion, hydrogen peroxide, Hydride anion etc. Form and can denaturalize protein and nucleic acid.[17] But body has antioxidant enzymes which removes free radical, so it maintain homeostasis from oxidative stress.[18] In typical antioxidant enzymes, there are SOD (superoxide dismutase), CAT (catalase), GPX (glutathione peroxidase) etc. It exists in mitochondria and other tissues, and if incase all sort of radical and reactive oxygen species occurs, antioxidant enzymes activates and remove or dilute it. But these enzymes has a limitation that excess production and action under special circumstances (strenuous exercise, smoking, ultraviolet light, environmental toxic substance etc) and reports that it turned out those who have not been trained appears to be trend more clearly.[19-21]

For such reason, this study wanted to investigate correlations of the physical fitness and antioxidant enzymes in exercised group who have been to train regularly or controls who have not been to train. After test was over, group who have been to train regularly turned up there is significant correlations, statistically at back strength and SOD (r=0.82, p=0.04), back strength and MDA (r=0.94, p=0.00), agility and GPX (r=0.81, p=0.04), balance and GPX (r=0.81, p=0.04). While dominant grip strength and MDA (r=−0.84, p=0.03), agility and GPX (r=−0.82, p=0.04) were appeared within significant correlation in controls. These result has in common with a research Ohno et al,[19] Ji,[21] Reddy and Fernandes,[22] and Vincent et al.[23] reported, which was antioxidant enzymes activation and level of lipid peroxidation's level etc. has a difference on whether or not participated in training. For reference, according to the research on the correlations between antioxidant enzymes malonaldehyde by Ko and Roh,[24] correlation between MDA and SOD coefficient appeared 0.16, not significant statistically and also there was no significant correlation between SOD and GPX. While correlation between MDA and GPX coefficient appeared 0.53, reported it has significant correlation. Such results are thought to be a partial vitalization of the GPX as a protective electric generation against stress of MDA occurring through oxidative stress.

On the other hand, the lipid elements in blood according to regular exercise has been thought to show similar changes as antioxidant enzymes as proposed above. In this study it observed total cholesterol (TC), triglycerides (TG), high density lipoprotein (HDL). For reference, it observed with blood lactic acid concentration to evaluate fatigability toward exercise training. Concretely total cholesterol are composed with 17% of cholesterol, 70% of low density lipoprotein, and are composed with about 13% very low-density lipoprotein.[25] The cause of total cholesterol content are related to many factors such as dietary life, exercise, gender, genetics, social tension etc. are high relation to chronic disease. Some researchers says normal range of total cholesterol is 150～200 mg/dl, and if this range decrease less than 50 mg/dl, pernicious anemia, malnutrition and hyperthyroidism symptoms appears. If increase more than 300 mg/dl, gallbladder disorder, arteriosclerosis, myxedema, diabetes symptoms can appear.[26] Meanwhile, high density lipoprotein which reverse total cholesterol, are lipoprotein which are composed with 50% of apoprotein A, 25% of hosepholipid, 20% of cholesterol and 5% of triglycerides.[27] Peripheral tissue cells within the body contains a special period for HDL-C and the vitality rate is controlled by the amount of cholesterol within the cell and plays an important role in riding the cholesterol form the cell. From among the studies of cholesterol rate within High Density Lipoprotein within the blood, according to Hunter's research[28] every time the concentration rate of cholesterol within the High Density Lipoprotein increases 10 mg/dl the danger of cardiovascular decreased by 50%. While Mensink et al.[29] also claim that a increase of 1 mg/dl showed a 2% decrease of cardiovascular disease in men and 3% decrease in women. While triglycerides, which has a similar role to cholesterol, 3 molecule of fatty acid are 3 plus, a fused mix between alcohol and glycerolin ester is the most common, taking up 98% of all existing lipids in the natural sector taking on the role of energy storage. As the most common lipid and is produced in fat tissue, muscular tissues and liver tissues allowing a quick and efficient taking part in efficient energy metabolism. But if triglycerides figure increases over 200 mg/dl, it causes arteriosclerosis and various chronic disease. It reports that this reason is, with decreasing activation of lipase, which is for lipolysis in the blood, lipoprotein remove rate decrease, which has lots of TG.[13] These lipid components in the blood have great difference at whether or not exercised regularly. And also appears various correlations between exercise group and controls. These lipid components in the blood are more affected regular according to regular exercise participation. Furthermore it is opinion of many authors that correlations also vary according to amount of exercise participa-

tion. In this studies observation of correlation between lipid in the blood and physical fitness, statistically in exercise group appeared there was no significant level of variable. While back strength and TG (r=0.88, p=0.01), agility and HDL (r=−0.84, p=0.03) appeared in controls. These results can interpret that grip strength and agility has no relation with effect of exercise. And it appears to be same with the past research that TG or HDL offer effects when performing endurance exercise. According to the research by Jo,[30] swimming 4 times a week for 12 times weekly for 60 minutes, also while Lee et al.[31] directed to a overweighed student and directed to do aerobic exercises 3 times a week for 90 minutes for 12 weeks at 70～85% as maximum heart rate the result was a 9.226% increase in HDL. Looking at the test results and seeing the results one could understand the result outcome of this test.

Regular exercise is thought to deduct various correlations to both the athletic and non-athletic by giving change to ideal variables and cardiovascular variables.[32] Concretely regular physical activity maintain cardiovascular function smoothly and can increase maximum oxygen consumption, and cause positive change at systolic blood pressure and heart rate etc.[33] Such results of these precedent researches suggest that regular exercise could make difference between variables. This study was started by such curiosity. It appeared different correlation between physical fitness and cardiovascular variables in exercised group who have been to train regularly and controls who have not been to train. Concretely while in exercise group variable that shown significant correlation between physical fitness and cardiovascular variables, statistically appeared non dominant grip strength and SBP (r=0.94, p=0.00), dominant grip strength and SBP (r=0.85, p=0.03), agility and SBP (r=0.82, p=0.04), variables that shown significant correlation between physical fitness and cardiovascular variables, statistically appeared dominant grip strength and DBP (r=−0.85, p=0.03), muscular endurance and ST level (r=−0.93, p=0.00), muscular endurance and HR (r=−0.88, p=0.01) in controls. Such results are thought to be deducted by the fact of participating in regular exercise or not as explained before. While to an athlete systolic blood pressure can cause unexpected effects while to a civilian with no regular exercise, it is evaluated that it may cause negative affects usually on the cardiovascular system.

V. Conclusion

The following result of this study, which was to investigate correlations of the physical fitness, antioxidant enzymes (SOD, CAT, GPX), lipid peroxidation's level (MDA), lipid profile, lactate levels and cardiovascular variables in exercised group who have been to train regularly or controls who have not been to train, is like this. In exercise group, variables that shown significant correlation between physical fitness and antioxidant enzymes, statistically appeared back strength and SOD (r=0.82, p=0.04), agility and GPX (r=0.81, p=0.04), balance and GPX (r=0.81, p=0.04) but in controls it appeared agility and GPX (r=−0.82, p=0.04). In exercise group, variables that shown significant correlation between physical fitness and MDA, statistically appeared back strength and MDA (r=0.94, p=0.00). And in controls, it appeared dominant grip strength and MDA (r=−0.84, p=0.03). In exercise group, correlation between physical fitness and TC, TG and HDL, statistically appeared not significant, but back strength and TG (r=0.88, p=0.01), agility and HDL (r=−0.84, p=0.03) appeared in controls. In exercise group and controls, it appeared there was no significant level of variables correlation between physical fitness and lactate concentration, statistically. In exercise group, variables that shown significant correlation between physical fitness and cardiovascular variables, statistically appeared dominant grip strength and SBP (r=0.85, p=0.03), agility and SBP (r=0.82, p=0.04) but dominant grip strength and DBP (r=−0.85, p=0.03), muscular endurance and ST level (r=−0.93, p=0.00), muscular endurance and HR (r=−0.88, p=0.01) appeared in controls. In conclusion, exercise makes a difference in physical fitness and especially such changes antioxidant enzymes, lipid peroxidation, blood Lipid and lactic acid also cardiovascular variables may deduct the correlations between exercise group and controls. But considering this research object is minority, making this result generalize is a bit hard to consider. So suggesting that concrete research based on more numbers of subjects is needed further more.

Author Contributions

Research design: Yu JH
Acquisition of data: Yu JH
Analysis and interpretation of data: Yu JH
Drafting of the manuscript: Yu JH
Research supervision: Lee SM

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